Integration of Stochastic Finite Element Capabilities into Analysis Software

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The stochastic finite element method permits the characterization of predictions from numerical models as random variables and processes. This allows the quantification of scatter in the predictions that is consistent with observed scatter in the data used to calibrate the model. The Spectral Stochastic Finite Element method (SSFEM) provides an approximation of the predictions from mechanics-based simulations in a format that lends itself to probabilistic analysis suitable for decision making under uncertainty. The methodology permits the extension of concepts developed for adaptive mesh refinement to the realm of data and information refinement. The theoretical foundation of the method consist of a blend of measure theory and functional analysis, permitting the definition of orthogonal projections and meaningful "best" approximants for random variables and vectors.

The presentation introduces the elements of a software library for the integration of stochastic prediction capabilities with general purpose finite element analysis software. The linking of this library with the Salinas Structural Dynamics FEA software is described and demonstrated.